CLAIMS

1. An exposure method which illuminates a first object with an exposure beam and exposes a second object with the exposure beam through the first object and a projection optical system, characterized in that

at least a part of the first object and the projection optical system is irradiated with a light beam having a wavelength range different from that of the exposure beam through a space waveguide mechanism, to correct an imaging characteristic of the projection optical system.

2. An exposure method as recited in claim 1, characterized in that the space waveguide mechanism includes a hollow waveguide made of glass, ceramics, or metal.

3. An exposure method which illuminates a first object with an exposure beam and exposes a second object with the exposure beam through the first object and a projection optical system, characterized in that

at least a part of the first object and the projection optical system is irradiated with a light beam having a wavelength range different from that of the exposure beam and being in a predetermined polarization state through a polarization state control mechanism, to correct an imaging

characteristic of the projection optical system.

4. An exposure method as recited in claim 3, characterized in that the polarization state control mechanism includes a phase plate.

5. An exposure method which illuminates a first object with an exposure beam and exposes a second object with the exposure beam through the first object and a projection optical system, characterized in that

at least a part of the first object and the projection optical system is irradiated with a light beam having a wavelength range different from that of the exposure beam and being in a predetermined polarization state through an optical guide and a polarization state control mechanism, to correct an imaging characteristic of the projection optical system.

6. An exposure method as recited in claim 5, characterized in that the optical guide is a hollow fiber.

7. An exposure method as recited in claims 5 or 6, characterized in that the polarization state control mechanism is a polarization plate.

8. An exposure method as recited in any one of claims

1 to 7, characterized in that

the light beam is generated by an RF excited waveguide type CO_2 laser.

9. An exposure method as recited in any one of claims 1 to 8, characterized in that

the at least the part of the first object and the projection optical system is illuminated in a rotationally asymmetric light-quantity distribution with the exposure beam, and

the light beam is applied so as to correct a rotationally asymmetric aberration of the projection optical system generated by the irradiation of the exposure beam.

10. An exposure method as recited in claim 9, characterized in that

a generated amount of the rotationally asymmetric aberration is calculated based on an irradiation amount of the exposure beam, and

the light beam is applied based on the calculated result.

11. A device production method including a lithography process characterized in that

a pattern is transferred onto a photosensitive

element using the exposure method as recited in any one of claims 1 to 10.

12. An exposure apparatus which illuminates a first object on which a pattern for transfer is formed with an exposure beam and exposes a second object with the exposure beam through the first object and a projection optical system, characterized by comprising:

an irradiation mechanism which irradiates at least a part of the first object and the projection optical system with a light beam having a wavelength range different from that of the exposure beam, wherein

the irradiation mechanism includes a space waveguide mechanism which guides the light beam along a predetermined optical path.

13. An exposure apparatus as recited in claim 12, characterized in that

the space waveguide mechanism includes a hollow waveguide made of glass, ceramics, or metal.

14. An exposure apparatus which illuminates a first object on which a pattern for transfer is formed with an exposure beam and exposes a second object with the exposure beam through the first object and a projection optical system, characterized by comprising:

an irradiation mechanism which irradiates at least a part of the first object and the projection optical system with a light beam having a wavelength range different from that of the exposure beam, wherein

the irradiation mechanism includes a polarization state control mechanism which sets a polarization state of the light beam to a predetermined state.

15. An exposure apparatus as recited in claim 14, characterized in that

the polarization state control mechanism includes a phase plate.

16. An exposure apparatus which illuminates a first object on which a pattern for transfer is formed with an exposure beam and exposes a second object with the exposure beam through the first object and a projection optical system, characterized by comprising:

an irradiation mechanism which irradiates at least a part of the first object and the projection optical system with a light beam having a wavelength range different from that of the exposure beam, wherein

the irradiation mechanism includes an optical guide which guides the light beam from a light source which generates the light beam, and a polarization state control mechanism which sets a polarization state of the light beam

emitted from the optical guide to a predetermined state.

17. An exposure apparatus as recited in claim 16, characterized in that

the optical guide is a hollow fiber.

18. An exposure apparatus as recited in claims 16 or 17, characterized in that

the polarization state control mechanism is a polarization plate.

19. An exposure apparatus as recited in any one of claims 12 to 18, characterized in that

the irradiation mechanism includes an RF excited waveguide type CO_2 laser as the light source which generates the light beam.

20. An exposure apparatus as recited in claim 19, characterized in that

there are a plurality of the RF excited waveguide type CO_2 lasers.

21. A exposure apparatus as recited in any one of claims 12 to 20, characterized in that

the irradiation mechanism includes a first beam splitter which splits the light beam.

22. An exposure apparatus as recited in any one of claims 12 to 21, characterized in that

the irradiation mechanism includes at least one of a movable mirror and a shutter in order to time-divide the light beam.

23. An exposure apparatus as recited in any one of claims 12 to 22, characterized by comprising:

a light source control unit which controls a light emitting duration of a light source which generates the light beam.

24. An exposure apparatus as recited in claim 13, characterized in that

an inner surface of the waveguide is coated with a reflective film including at least one of a metal film and a dielectric film in order to reflect the light beam.

25. An exposure apparatus as recited in any one of claims 12 to 24, characterized by comprising:

a second beam splitter which divaricates a portion of the light beam, and a photoelectric sensor which receives the light divaricated by the second beam splitter, wherein

information on a light quantity of the light beam is obtained with the photoelectric sensor.

26. An exposure apparatus as recited in claim 25, characterized by comprising:

at least one polarization element disposed between the light source of the light beam and the second beam splitter.

27. An exposure apparatus as recited in claims 25 or 26, characterized by comprising:

a 1/4 wavelength plate, disposed between the second beam splitter and an optical member constituting the projection optical system, which sets a polarization state of the light beam to a predetermined state.

28. An exposure apparatus as recited in any one of claims 12 to 27, characterized in that

the at least the part of the first object and the projection optical system is illuminated in a rotationally asymmetric light-quantity distribution with the exposure beam, and

the irradiation mechanism applies the light beam so as to correct a rotationally asymmetric aberration of the projection optical system generated by the illumination of the exposure beam.

29. An exposure apparatus as recited in claim 28,

characterized by further comprising:

an aberration correction mechanism which corrects the rotationally symmetric aberration of the projection optical system, and

a control unit which controls operations of the irradiation mechanism and the aberration correction mechanism to correct an aberration of the projection optical system.

30. A device production method including a lithography process, characterized in that

a pattern is transferred onto a photosensitive element in the lithography process using the exposure apparatus as recited in any one of claims 12 to 29.